From:	Citrin, Jacob <jcitrin@cargoventures.com>
Sent:	Wednesday, March 2, 2016 7:10:10 PM
To:	Christine Lux <CLux@stavis.com>
Subject:	Press Release Information
Attachments:	why chose co2 (5).pdf

Christine,

Please see the following bullet points on the building:

1. To be developed on Parcel 5 of the Massport Marine Terminal.
2. Building is planned to be 200,000 sq. ft. of state-of-the-art seafood processing and industrial space.
3. Stavis Seafoods will be the anchor tenant kicking-off the building and will be leasing upwards of 90,000 sq. ft. of freezer, cooler, processing and office space located on the waterfront in the Port of Boston.
4. Building will be utilize the latest in construction technologies and will be the most technologically advanced seafood processing facility in Boston when completed.
5. Among its attributes, the Stavis facility will include a Cascade Refrigeration System which is a hybrid CO2/Ammonia refrigeration plant that is the most energy efficient and environmentally friendly available.
6. The building will represent an investment in excess of $40 million into the Seafood industry at the Port of Boston making it one of the largest private investments at the Port.

I am also attaching a longer brief that describes the refrigeration plant.

Please send me a draft of the press release once available and let me know if you need anything further. Apologies for the delay.

Thanks.

Jake

JACOB CITRIN
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Should I Chose CO_2 (R-744) for my refrigeration system?

The application of Cascade Carbon Dioxide and Ammonia (Cascade CO_2/NH_3) refrigerating systems has been gaining popularity in North America the past number of years, but to correctly answer this question one must first identify their objectives for the refrigeration plant. For example:

- What temperatures do you need to maintain;
- Are there product freezing requirements;
- Is maintaining a reduced Ammonia system charge critical (most systems under 10,000 lbs.);
- Is having no contaminating refrigerants in the food storage, processing and employee work areas desirable; and,
- Is providing a "Green" refrigeration system important?

These are just a few considerations one should first think about.

Obviously cost is always an important factor in any project. If your project does not require storage temperatures below 0°F to -4°F (-17.8°C to -20°C) and there is no blast freezing and very little room freezing requirement, the most cost effective and efficient refrigerating system would be a Single Stage Economized Ammonia refrigeration system. However, if your storage temperature requirements are below -4°F and there is considerable room and or blast freezing requirements you should carefully consider the benefits of a Cascade CO_2/NH_3 refrigerating system. Additionally, depending upon the size of the refrigerated facility the installed cost of a Cascade CO_2/NH_3 refrigerating system is often less than an equivalent two-stage Ammonia system. The primary factors contributing to the lower cost are:

- Smaller low stage compressors,
- Smaller low temperature suction piping, valves, and liquid separating vessels,
- Less piping and vessel insulation; and,
- Lower refrigerant (CO2) costs.

When lower temperatures than mentioned above are required, the operating cost of a Cascade CO_2/NH_3 refrigerating system becomes very attractive. A third-party energy company conducted a comprehensive study of a Cascade CO_2/NH_3 system modeled against an equivalent two-stage Ammonia system. The project included field installed instrumentation and data acquisition equipment to monitor and evaluate the real-time performance of the refrigeration plant which included refrigerated storage spaces, ultra-low temperature blast freezers having the ability to operate at temperatures lower than those commonly obtained with conventional Ammonia systems. The Cascade CO_2/NH_3 system operates at the following nominal process temperatures (i.e., saturated suction temperatures): -58°F CO_2 blast freezing; -20°F CO_2 freezer storage; +20°F CO_2 coolers and docks; and, +11°F NH_3 high stage. The conventional Ammonia system was modeled for the following temperatures: -58°F NH_3 blast freezing; -20°F NH_3 freezer storage; and, +20°F NH_3 high stage, coolers and docks.

The efficiency of the Cascade CO_2/NH_3 refrigerating system was measured in kilowatts per ton of refrigeration load (kW/TR). After five months of monitored operation the comparison of the Cascade CO_2/NH_3 refrigerating system efficiency to the efficiency calculated for the conventional two-stage Ammonia system indicated: the Cascade CO_2/NH_3 combined (-58°F and -20°F suction groups) efficiency shows a 28.7% improvement compared to the conventional Ammonia system. However, the Cascade CO_2/NH_3 overall system efficiency is reduced somewhat as a result of a lower high stage suction temperature compared with the conventional Ammonia system; resulting from the 9°F temperature difference required by the Cascade heat exchangers between the CO_2 compressors +20°F saturated discharge temperature and the +11°F Ammonia high stage saturated suction temperature. Moreover, the Cascade CO_2/NH_3 system showed a 5.8% overall efficiency improvement over the conventional Ammonia system. Table 1 below shows summary results of the comprehensive energy study conducted by the third party energy company.

Cascade CO_2/NH_3 vs. Two Stage Ammonia
Study Conducted by Pacific Gas and Electric Company (PG&E)

System Efficiency Results

	2-Stage NH3 Reference System [kW/TR]	CO2/NH3 Cascade System [kW/TR]	% Improvement In Efficiency
-20F Suction Group	0.8	0.7	12.3
-58F Suction Group	1.6	1.0	37.3
Combined -20F and -58F Suction Groups	1.2	0.9	28.7
High Temp Suction Group	0.7	0.8	-8.5
Total SystemkW/TR (Compressors)	1.7	1.6	8.1
Total System kW/TR (Compressors and Condenser)	1.9	1.8	6.8
Total System kW/TR (Compressors, Condenser and Air Units)	2.4	2.3	5.8

Table 1

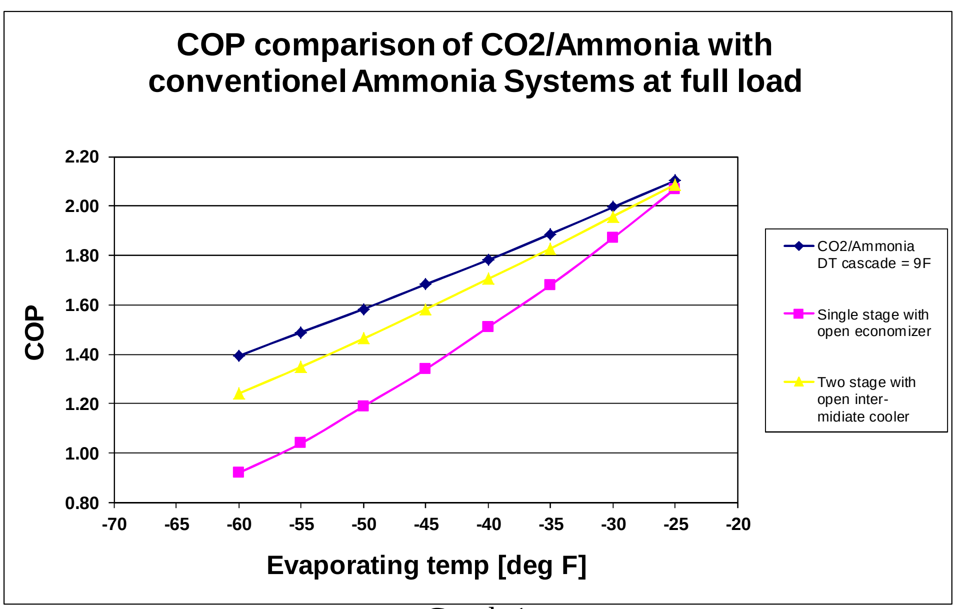
Many refrigeration engineers and service technicians have generally reached the opinion that there is very little difference between maintaining a CO_2 system compared to an Ammonia system.

When comparing the performance of a high pressure CO_2 reciprocating compressor vs. the high pressure CO_2 rotary screw compressor, the efficiency (BHP/TR) of the reciprocating compressor is considerably better. See Table 2 below.

Approximate CO_2 Ratings Screw @ 3,600 rpm; vs. Recip. @1,170)								
		Screw @ 20°F CT			**HPC 108S @ 20°F CT**			**% Diff. Bhp/TR**
		Tons	**Bhp**	**Bhp/TR**	**Tons**	**Bhp**	**Bhp/TR**	
Suction Temperature °F	-58	102.1	233.0	2.28	100.0	148.5	1.49	53.68%
	-50	122.6	214.6	1.75	124.7	156.1	1.25	39.83%
	-40	152.3	195.3	1.28	160.8	161.0	1.00	28.07%
	-30	186.9	181.7	0.97	202.9	160.5	0.79	22.90%

Table 2

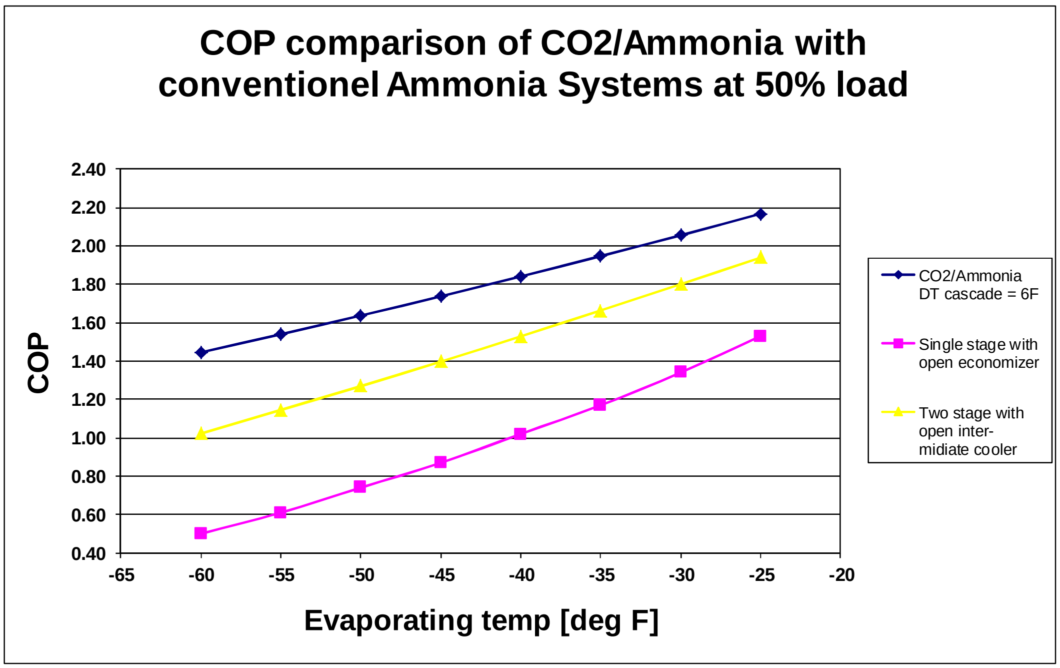
Other benefits of the reciprocating compressor are its part load characteristics. Many refrigeration systems do not operate at peak design load at all times; and, it is necessary to either have multiple compressors of varying sizes of compressor(s) that will unload.



Graph 1

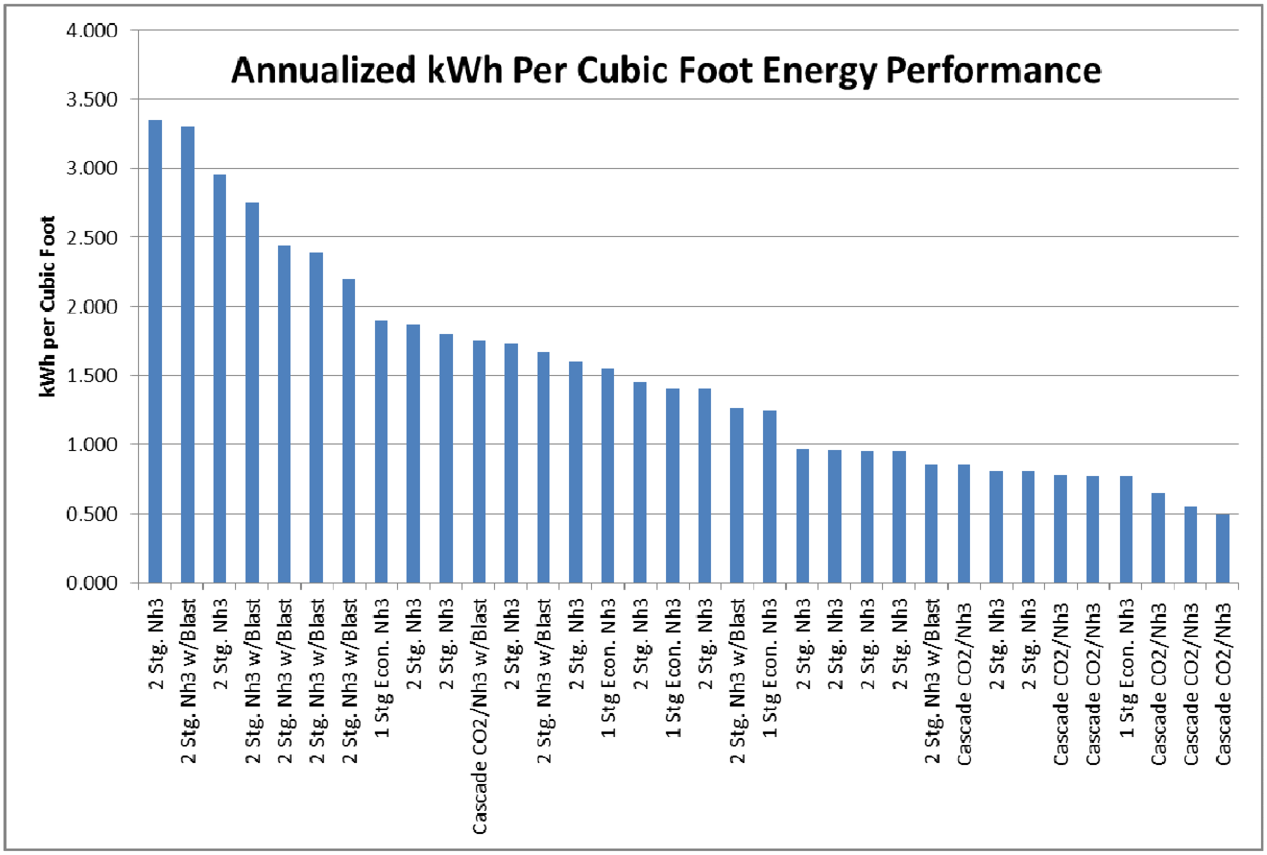
Graph 1 above shows the Coefficient of Performance (COP) of CO_2/Ammonia with conventional Ammonia systems at full load. Note that at a -25°F Saturated Suction Temperature all three types of systems; i.e., Single Stage Ammonia, Two Stage Ammonia and CO_2/Ammonia are approximately equal. However, as the suction temperature is lowered the performance of the CO_2/Ammonia system is considerably better that the Single Stage and Two Stage Systems.

Graph 2 below shows the Coefficient of Performance (COP) of CO_2/Ammonia with conventional Ammonia systems at 50% load. As shown by Graph 2, there is a considerable difference in COP at all Saturated Temperatures of the three different refrigeration systems. And, because many refrigeration systems do not operate at full load consistently, the Cascade CO_2/Ammonia system can usually offer lower energy costs.



Graph 2

Graph 3 below shows the energy and cost comparison, measured in kilowatt hours per cubic foot of refrigerated capacity, of different types of refrigeration system operating primarily in different refrigerated warehouses of varying age, locations, and internal operational activity. Note that the kWh per cubic foot ranges from slightly less than 0.50 to approximately 3.25 kWhrs per cubic foot. Obviously this is not an absolute measure of efficiency since the activity within a facility, ambient conditions and geographical location can greatly impact the energy consumption; however, it is worth mentioning that of the thirty four (34) facilities listed, seven (7) of the facilities are operating with a Cascade CO_2/Nh_3 refrigeration system. Six (6) of the Cascade CO_2/Nh_3 refrigeration system have a kilowatt hour per cubic foot consumption of less than one. The seventh the Cascade CO_2/Nh_3 refrigeration system, which has a considerable amount of blast freezing, is operating at approximately 1.65 kWh per cubic foot, which is considerably less than some of the other facilities operating with two-stage Ammonia system and having blast freezing operations.



Graph 3

Owners of refrigerated facilities are often confronted by various jurisdictions and government agencies to reduce the Ammonia refrigerant charge. A Cascade CO_2/NH_3 system will usually reduce the required amount of Ammonia by a factor of 10. Since all of the Ammonia is contained within the Engine Room and the Condenser on the roof, there is no contaminating refrigerant in the storage or processing areas thereby eliminating the risk of damaging product and causing possible injury to employees in the unlikely event of a refrigerant leak.

Finally, Ammonia and Carbon Dioxide are both natural refrigerants that do not have an effect on global warming and do not harm the ozone layer.

The following pages are a reference list of CO_2 systems designed by M&M Refrigeration, Inc.

M&M Refrigeration, Inc. **Reference list of CO2 (R744) installations** 10/18/2013

			Low Temperature		Medium Temperature		High Temperature	
Year	**Customer**	**Application**	**Capacity TR**	**Temp. degF**	**Capacity TR**	**Temp. degF**	**Capacity TR**	**Temp. degF**
2004	Agger Fish, Brooklyn, NY	Plate Freezers	50	-63				
2005	US Cold Storage Ph1, Bethlehem, PA	Storage			290	-30	165	20
2005	Flint River Services, Savannah, GA	Storage			150	-18	150	27
2006	Lincoln Cold Storage, Lincoln, NE	Plate Freezers	404	-58				
2006	US Cold Storage Ph1, Fresno, CA	Storage/Blast Freezers	220	-58	450	-25	210	20
2006	US Cold Storage Ph2, Bethlehem, PA	Storage			300	-30	155	20
2007	US Cold Storage Ph1, Lake City, FL	Storage			375	-25	125	20
2007	US Cold Storage Ph3, Bethlehem, PA	Storage			300	-30	130	20
2007	Border Cold Storage, Pharr, TX	Storage					320	20
2008	US Cold Storage Ph1, Hazelton, PA	Storage			347	-30	125	20
2008	Unitherm Food Systems, Bristow, OK	Spiral Freezer	25	-60				
2008	Circle Foods, San Diego, CA	Storage/Spiral Freezers	418	-38	60	-10		
2008	US Cold Storage Ph1, Lebanon, IN	Storage			414	-30	145	20
2008	US Cold Storage Ph1, Turlock, CA	Storage			408	-30	143	20
2009	US Cold Storage Ph2, Fresno, CA	Storage/Blast Freezers	54	-58	291	-25	168	20
2010	Frialsa, Mexico City, Mexico	Storage/Blast Freezers			519	-25	26	20
2010	US Cold Storage Ph2, Hazelton, PA	Storage			232	-30	60	20
2010	P.A.T.E, Tepatitlan, Mexico	Blast Freezers			300	-40		
2010	Marigold, Union Frozen, Bangkok, Thailand	IQF Freezer	115	-60				
2010	The Auction Block, Homer, Alaska	Blast Freezer/Storage	20	-40	10	-20		
2010	Wegmans Food Markets, Pottsville, PA	Storage					1000	20
2011	Ling's, El Monte, CA	Spiral Freezer	120	-60				

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2011	US Cold Storage Ph2, Turlock, CA	Storage			193	-30	286	20
2012	US Cold Storage Ph3, Hazelton, PA	Storage			98	-30		
2012	General Tuna Corp., Philippines	Blast Freezers	145	-58				
2012	US Cold Storage Ph2, Lake City, FL	Storage/Blast Freezers	128	-58	280	-25	80	20
2012	US Cold Storage Ph 3, Fresno, CA	Storage/Blast Freezers	96	-58	470	-25	60	20
2012	Marigold - Minor Dairy, Thailand	IQF Freezer	47	-56				
2012	Circle Foods, San Diego, CA	Spiral Freezer	152	-38				
2013	Frialsa, Monterrey, Mexico	Storage/Blast Freezers			507	-30	60	20
2013	Bonar Engineering, Nestle, Puerto Rico	Storage			88	-35	50	20
2013	Seenergy Foods, ON, Canada	IQF Freezer	80	-58				
2013	Pima Cold Storage, Costa Rica	Storage			34	-28	23	20